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Carbon rhizodeposition by plants of contrasting strategies for resource acquisition: responses to various nitrogen fertility regimes

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Rhizodeposition by plants is one of the most important physiological mechanisms related to carbon and nitrogen cycling which is also believed to vary along the acquisition-conservation continuum. However, owing to methodological difficulties (i.e. narrow zone of soil around roots and rapid assimilation by soil microbes), root exudation and variations between species are one of the most poorly understood belowground process. Although previous approaches such as hydroponic culture based system, permit the chemical analysis of exudates, the fact that this protocol is qualitative, conditions its utility (see review in Phillips et al. 2008). Others techniques based on pulse-labelling approach have been developed to quantify rhizodeposition but are rarely sufficient to uniformly label all plant inputs to soil. Consequently with this typical pulse chase methods, recent assimilates are labeled but the recalcitrant carbon will not be labeled and therefore the contribution of this carbon will not be considered. Hence, traditional pulse labelling is not a quantitative means of tracing carbon due to inhomogeneous labelling and so limits greatly comparative studies of rhizodeposition fluxes at the interspecific level.

In this study we developped a new protocole based on a long-term (3 months) steady state 13C labelling in order (1) to quantify rhizodeposition fluxes for six graminoid species caracterized by contrasted nutrient acquisition strategies and (2) to investigate to what extent various level of nitrogen fertility regimes modulate rhizodeposition fluxes. This method will enable to quantify under natural soil conditions both the accumulation of 13C in the soil but also the quantity that has been respired by the microorganisms during a given time and so will give an integrated picture of rhizodeposition fluxes for each species under each nitrogen fertility level.

Results are currently being processed and will be presented at the conference.

References:

Phillips RP, Erlitz Y, Bier R, Bernhardt ES. Functional Ecology 22: 990-999 (2008)